NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

OUTRIGGER TELESCOPES PROJECT

RECORD OF DECISION

A. BACKGROUND

The National Aeronautics and Space Administration (NASA) has a central Mission with three components: (1) to understand and protect our home planet, (2) to explore the universe and search for life, and (3) to inspire the next generation of explorers. The second component, to explore the universe and search for life, addresses two of humanity's oldest and most profound questions: "Where did we come from?" and "Are we alone?" Understanding where we come from requires knowledge of how today's universe of galaxies, stars, and planets came to be, and how stars and planetary systems form and evolve. Understanding whether or not we are alone requires knowledge about the building blocks of life, the conditions necessary to sustain life, and the diversity of planets—particularly those that might harbor life. Acquiring knowledge in all of these areas is the goal of NASA's Origins Program. In pursuit of this knowledge, NASA supports space flight missions, related research programs, and technology development.

Interferometry is a critical technology for accomplishing the Origins Program. It is a technique for overcoming an inherent limitation of single telescopes: the "sharpness" or amount of image detail is limited by the size of the telescope's main mirror. An interferometer combines two or more telescopes optically so they function as if they were a single larger telescope. The number of individual telescopes and the distances between them determines the sharpness of the image from an interferometer. Because the separation between telescopes can be much larger than the diameter of even the largest telescope mirrors, interferometers in general acquire images that capture much more detail than individual telescopes.

Interferometers also can measure positions of stars with exquisite accuracy. This is important because it is possible to find planets around other stars by measuring the stars' positions very accurately over a substantial period of time. As a planet orbits a star, it exerts a gravitational tug that causes the star to move back and forth. An interferometer can detect this slight "wobble," thus revealing the presence of the orbiting planet.

NASA is developing interferometry for use both in space and on the ground. Space flight missions, such as the Space Interferometry Mission, can achieve even finer measurements than are possible from the ground by getting above the Earth's atmosphere to avoid its image distortion. However, ground-based interferometers are essential for projects that require a longer operating life than is possible with a space flight mission. They can also involve telescopes that are larger and more sensitive than the ones that can be flown in space.

The Outrigger Telescopes Project is part of NASA's program to develop ground-based interferometry. The project as proposed addresses four of NASA's six scientific objectives for ground-based interferometry. These six objectives are:

1. Detect the thermal dust emissions from dust clouds around other stars.

2. Detect the light from and characterize the atmospheres of hot, Jupiter-mass planets located within approximately 20 million kilometers (km) (12 million miles (mi)) of the stars they are orbiting.

3. Detect the astrometric signature (*i.e.*, the wobble of a star due to the gravitational influence of an unseen planetary companion) of planets as small as Uranus.

4. Make images of proto-stellar disks (*i.e.*, disks of dust and gas in space believed to be an early stage of star formation) and stellar debris disks (*i.e.*, clouds of gas or other material remaining after the star is formed).

5. Provide high-resolution information about some faint objects outside our galaxy.

6. Make high-resolution observations of objects within the solar system, including asteroids, comets, and outer planets.

The first two objectives can be accomplished by the Keck-Keck Interferometer which links the two 10-meter (m) (33-foot (ft)) Keck Telescopes, located on the summit of Mauna Kea, island of Hawai'i. Objectives 3 through 6 require the Outrigger Telescopes. Objective 3, finding planets around nearby stars by means of astrometry, can be accomplished with four Outrigger Telescopes alone. Objectives 4 through 6 require that the Outrigger Telescopes be connected to one or more large (8-m (26-ft) diameter or larger) telescopes.

Six Outrigger Telescopes (the maximum number that could ultimately be components of the Outrigger Telescopes Project) would provide almost twice as much image detail as four in pursuit of objectives 4 through 6, yielding much higher quality scientific data.

B. THE ENVIRONMENTAL IMPACT STATEMENT

The Final Environmental Impact Statement (EIS) has been prepared to support decision-making on whether to fund the on-site construction, installation, and operation of four, and possibly up to six, Outrigger Telescopes at the W.M. Keck Observatory within the Mauna Kea Science Reserve on the summit of Mauna Kea, island of Hawai'i.

The State of Hawai'i leases the Mauna Kea Science Reserve to the University of Hawai'i (UH). UH subleases the W.M. Keck Observatory site to the California Institute of Technology (Caltech). The California Association for Research in Astronomy (CARA), a non-profit corporation established by the University of California and Caltech, operates and maintains the Keck Telescopes and the W.M. Keck Observatory site.

Pursuant to the National Environmental Policy Act (NEPA), NASA completed an Environmental Assessment (EA) for the Outrigger Telescopes Project in February 2002 and issued its decision document (Determination of Required Mitigation and Decision) on March 4, 2002.

The Office of Hawaiian Affairs (OHA) challenged NASA's EA and decision in Federal Court. In June of 2003, the Court remanded the EA and instructed NASA to reassess the cumulative impacts of the proposed Outrigger Telescopes Project. In November of 2003,

NASA announced its decision to voluntarily go beyond the Court's direction to reassess cumulative impacts in a new EA. NASA announced that it would instead prepare an EIS. NASA's decision to prepare an EIS recognized the deep concerns and feelings expressed for Mauna Kea by members and representatives of the Native Hawaiian community. On December 30, 2003, NASA published its Notice of Intent (NOI) to prepare an EIS and conduct scoping in the Federal Register (FR) (68 FR 75285). The NOI and a community notice were also published in the *Honolulu Star-Bulletin, Hawaii Tribune-Herald, West Hawaii Today, The Honolulu Advertiser,* and the *Pasadena Star News*. NASA held five public scoping meetings on the islands of Hawai'i and O'ahu in January 2004 and accepted public scoping comments until February 16, 2004.

NASA received many comments during the public scoping period, both orally at the public scoping meetings and in written submissions. The comments addressed issues included under the spirit and intent of NEPA and issues not so included. The latter were deemed out-of-scope for the EIS. The in-scope issues raised were primarily:

- Cultural impacts;
- Hazardous materials handling;
- Hydrology;
- Visual impacts to the view planes to and from Mauna Kea;
- Impacts to the Wēkiu bug and its habitat (the Wēkiu bug is a candidate for listing under the Endangered Species Act of 1973, as amended (16 U.S.C § 1531 *et seq.*); and
- Overall cumulative impacts to the summit region.

The EIS analysis focuses particularly on these areas.

Numerous comments were received on topics deemed out-of-scope for the EIS. These included, but were not necessarily limited to:

- The amount of lease rent ($1/year) formally received by the UH from each observatory on Mauna Kea;
- The overall management structure for the mountain;
- The status of the 2000 Master Plan for the Mauna Kea Science Reserve, particularly the issue of approval by the Department of Land and Natural Resources;
- The Conservation District Use Application by UH proceeding concurrently with the Federal EIS process;
- The relationship between NASA and the Department of Defense;
- The generation and distribution of income from ceded lands; and
- The overthrow of the Hawaiian monarchy.

On July 29, 2004, NASA published its Notice of Availability (NOA) for the Outrigger Telescopes Project Draft EIS in the FR (69 FR 47926). The NOA and a community notice were also published in *The Honolulu Advertiser*, *The Garden Island Newspaper, Honolulu Star-Bulletin, The Maui News, Hawaii Tribune-Herald, West Hawaii Today, Hawai'i Island Journal,* and the *Pasadena Star News*.

The public comment period began August 6, 2004 and ended September 30, 2004. Six public meetings were held on the islands of Hawai'i, O'ahu, and Maui in late August/early September 2004. To facilitate comments from people unable to attend the public meetings, hard copies of the Draft EIS were sent to each library within the Hawai'i State Public Library System, as well as Regional Libraries and Colleges. Hard copies of the Draft EIS were also sent to various governmental agencies, organizations, and interested persons. In addition, the Draft EIS was made available on the World Wide Web.

NASA received a total of 329 written comments and 86 oral comments. Appendix G, Volume II of the Final EIS provides summaries of the oral comments with responses and the verbatim written comments with responses. Where a large number of comment submissions were essentially identical, a representative submission was published accompanied by a list of persons who submitted very similar comments. Comments received addressed issues included under NEPA and issues not so included. The latter were deemed out-of-scope for the Final EIS. The in-scope issues raised were similar to those raised during the public scoping period.

Many parties commented on the sanctity of Mauna Kea and other aspects of the natural environment in Native Hawaiian culture. In recognition of this sanctity, NASA made particular effort to obtain comments and perspectives from Native Hawaiian religious practitioners (see Section 3.1.2.5 of the Final EIS for more details).

Many parties also expressed concern about past management practices on Mauna Kea. Several discussed strained relationships with other governmental organizations (*e.g.*, the Department of Defense), and expressed heartfelt concern about the ability of Native Hawaiians to respond to the many assaults they see being made upon their culture and heritage.

On February 11, 2005, NASA published its NOA for the Outrigger Telescopes Project Final EIS in the FR (70 FR 7310). The NOA was also published in *The Honolulu Advertiser*, *The Garden Island Newspaper, Honolulu Star-Bulletin, The Maui News, Hawai'i Island Tribune, West Hawaii Today, Hawai'i Island Journal, North County Times,* and the *Pasadena Star News*.

Hard copies of the Final EIS were sent to each library within the Hawai'i State Public Library System as well as Regional Libraries and Colleges. Hard copies of the Final EIS were also sent to various governmental agencies, organizations, and interested persons. Persons and organizations that were sent a copy of the Draft EIS or commented on that document were sent a copy of the Final EIS. The Final EIS was also made available on the World Wide Web.

NASA received no comments on the Final EIS from the public. NASA did receive a letter with comments from the Region IX Office of the U.S. Environmental Protection Agency in San Francisco. That letter is discussed later in this document.

Alternatives Considered

NASA used specific screening criteria to evaluate alternative sites for accomplishing the full set of science objectives of the Outrigger Telescopes Project. The screening criteria were arranged in two tiers. The *Tier 1* criteria addressed whether the Outrigger Array could be built at a particular site and its capability, if built there, to accomplish the Outrigger Telescopes Project's scientific objectives. The *Tier 1* criteria included:

- northern hemisphere location to maximize sky coverage;
- existing telescope of at least 8-m (26-ft) aperture;
- adequate land available for Outrigger Telescope baselines; and
- superior site observing quality.

The *Tier 2* criteria addressed programmatic and technical considerations associated with building the Outrigger Array at that site. Such considerations included, but were not necessarily limited to, cultural and environmental sensitivity, the technical challenges involved in connecting the Outrigger Telescopes to the existing large telescope(s), schedule, telescope observing time, and cost. See Section 2.2 of the Final EIS for more details.

NASA systematically evaluated the sites of all 8-m (26-ft) or larger telescopes either operational or expected to be operational within the next few years as potential sites for locating the Outrigger Telescopes Project. These ten sites are:

- W.M. Keck Telescopes, Mauna Kea, Hawai'i;
- Very Large Telescope Interferometer, Cerro Paranal, Chile;
- Gemini South Telescope, Cerro Pachón, Chile;
- Magellan Telescope, Las Campanas, Chile;
- Gran Telescopio Canarias, La Palma, Canary Islands, Spain;
- Large Binocular Telescope, Mt. Graham, Arizona;
- Subaru Telescope, Mauna Kea, Hawai'i;
- Gemini North Telescope, Mauna Kea, Hawai'i;
- Hobby-Eberly Telescope, Mt. Fowlkes, Texas; and
- South African Large Telescope, Sutherland, South Africa.

Of the ten sites evaluated, one site emerged as a reasonable alternative (Canary Islands Site Alternative) to the Mauna Kea site (Proposed Action and preferred alternative). The

remaining eight sites failed to meet all of the site screening criteria as described in Section 2.2 of the Final EIS. The W.M. Keck Observatory site on Mauna Kea, Hawai'i and the Gran Telescopio Canarias (GTC) on La Palma, Canary Islands, Spain meet or surpass all of the site screening criteria described in Section 2.2 of the Final EIS.

1. Description of the Alternatives Considered in Detail

A) Proposed Action and Preferred Alternative

NASA's Proposed Action and preferred alternative has been to fund the on-site construction, installation, and operation of four, and possibly up to six, Outrigger Telescopes at the W.M. Keck Observatory site located within the Astronomy Precinct on the summit of Mauna Kea, island of Hawai'i.

The W.M. Keck Observatory site on Mauna Kea is the location of the two most powerful optical telescopes in the world—Keck I and Keck II. The W.M. Keck Observatory, as well as eleven others, is located in the Astronomy Precinct, an area of 212 hectares (525 acres) within the Mauna Kea Science Reserve. The proposed Outrigger Telescopes would be placed strategically around the existing Keck Telescopes on the area of the cinder cone, Pu'u Hau'oki, that was previously disturbed for construction of the two Keck Telescopes. NASA anticipates that on-site construction and installation of four Outrigger Telescopes along with on-site construction of the underground structures for Outrigger Telescopes 5 and 6 would begin in 2005 (assuming all permits and approvals have been received) with start of operations anticipated in 2007. If funding becomes available, NASA intends to complete the above-ground construction, installation, and operation of Outrigger Telescopes 5 and 6, with on-site construction and installation likely to begin no earlier than 2007.

Each proposed Outrigger Telescope would consist of a 1.8-m (6-ft) diameter, f/1.5 primary mirror, a secondary mirror, a tertiary mirror, and other optical equipment. A dome, measuring 9.1 m (30 ft) in diameter at its widest point and 8 m (26 ft) in diameter at its base, would enclose each telescope to protect it from the harsh conditions on Mauna Kea. The domes would stand 10.7 m (35-ft) high as measured from the top of the level grade at elevation 4,146 m (13,603 ft). By comparison, each of the Keck domes is 37 m (121 ft) in diameter at its widest point and 33.9-m (111-ft) high. Each proposed Outrigger Telescope would be supported by an underground concrete telescope instrument room, which would serve as a telescope pier. Junction boxes would house the mirrors that direct the light beams through underground light pipes to the basement of the Keck II Telescope building, where the interferometer instrumentation is located.

B) Canary Islands Site Alternative

The GTC, a 10-m (33-ft) telescope modeled after the Keck Telescope, is currently under construction on the island of La Palma in Spain's Canary Islands, about 1,800-km (1,100-mi) southwest of Madrid, Spain. The GTC site is located within the Roque de Los Muchachos Observatory (ORM) near the northern end of the island.

The ORM is located at an elevation of approximately 2,400 m (7,900 ft) above mean sea level and occupies the north slope of a large volcanic caldera, the most prominent feature on La Palma. The 189-hectare (ha) (467-acre (ac)) science site supports more than a

dozen observatories. The GTC site may be characterized as a broad northwest sloping (18 percent) plain of altered volcanic material. A sizeable area adjacent to the GTC site has been disturbed by material staging and construction activities, but other adjacent area is undisturbed.

Locating the Outrigger Telescopes Project at the GTC site would involve the construction of four, and possibly up to six, 1.8-m (6-ft) Outrigger Telescopes together with their enclosures and domes, light pipes to transport the light from each telescope to a central beam combiner, and a separate structure to house the beam combiner facility. The telescopes themselves would be identical to those proposed for the Mauna Kea site. The GTC is being constructed with a coudé tunnel beneath the building which allows light from the 10-m (33-ft) telescope to be brought outside the observatory structure. This light path would feed directly into the beam combiner facility. The light pipes relaying light from the Outrigger Telescopes would also feed into the beam combiner facility, where a complex system of optics would combine the light of the various telescopes together interferometrically.

2. Description of the No-Action Alternative

Under the No-Action Alternative, NASA would not fund the on-site construction, installation, or future operation of the Outrigger Telescopes Project. NASA's purpose and need for the project would not be met. Thus, NASA would be unable to meet any of the four science objectives of the Outrigger Telescopes Project discussed in Section 1.2 of the Final EIS. In addition, the No-Action Alternative would result in economic losses to the State of Hawai'i of the estimated $12 to $13 million for the on-site construction and installation of six Outrigger Telescopes. Further, the State of Hawai'i would lose the incremental revenues associated with operation of the Outrigger Telescopes Project. NASA would not fund the Wēkiu bug on-site mitigation, the autecology study, and the Wēkiu bug monitoring activities. NASA also would not fund the $2 million initiative for preservation and protection of historic/cultural resources on Mauna Kea and educational needs of Hawaiians.

The Canary Islands and Spain would suffer a similar economic loss under the No-Action Alternative.

3. Reduced Science Option

Of the four scientific objectives identified for the Outrigger Telescopes Project, three require the use of an 8-m (26-ft) or larger telescope. One objective, precision astrometry of nearby stars to search for planets, can be accomplished using only the Outrigger Telescopes.

NASA has investigated alternative site locations for the Outrigger Telescopes (four Outrigger Telescopes combined) to accomplish the astrometry program. Because location at an alternative site would accomplish only one of four scientific objectives, NASA considers this a Reduced Science Option.

NASA identified two candidate sites for the Reduced Science Option that warranted detailed study. The two sites are Mount Wilson Observatory (MWO) in Los Angeles

County, California and the Palomar Observatory in northern San Diego County, California.

Environmental Impacts

1. Key Environmental Issues Evaluated

The key environmental issues of implementing the Proposed Action are those that would affect cultural resources, the visual integrity of the summit region of Mauna Kea, and impacts to the Wēkiu bug, a candidate for listing under the Endangered Species Act.

NASA analyzed the potential impacts that might occur to cultural resources; biological resources and threatened and endangered species; hydrology; water quality and wastewater; solid waste and hazardous materials management; geology, soils, and slope stability; land use and existing activities; transportation; utilities and services; socioeconomics; air quality; noise; and visual/aesthetics resources for each alternative.

NASA also considered the incremental impact of the Proposed Action when added to other past, present, and reasonably foreseeable future actions (cumulative impacts) for each resource. Past and present actions included those actions that occurred on or adjacent to Mauna Kea since astronomy facilities were established on Mauna Kea in May 1964. There are currently 12 observatories operating on Mauna Kea. Other notable past and present activities considered in the cumulative impacts analysis include construction of the Mauna Kea Access Road and development of the Mid-Elevation Support Facilities on Hale Pōhaku. See Section 4.2.1 of the Final EIS for additional information. Reasonably foreseeable future activities considered in the cumulative impacts analysis include identified potential on-site construction or implementation of astronomy and non-astronomy-related projects on or near Mauna Kea through December 31, 2033, the end of the Mauna Kea Science Reserve lease agreement between UH and the State of Hawai'i. These future activities include both new construction and recycled facilities. All of the reasonably foreseeable future activities remain conceptual in nature. See Section 4.2.2 of the Final EIS for additional information.

2. Environmental Impacts of the Alternatives

A) Proposed Action

Cultural Resources. There would be a short-term small-to-moderate adverse impact on cultural practices from noise, dust, and construction materials and equipment during on-site construction and installation of the Outrigger Telescopes. The operation of the Outrigger Telescopes would have a small adverse effect on the traditional cultural property and contemporary religious and cultural practices associated with the mountain.

From a cumulative perspective, the impact of past, present, and reasonably foreseeable future activities on cultural resources on Mauna Kea is substantial and adverse. The addition of the Outrigger Telescopes to the existing observatories on the mountain would have a small incremental impact.

Biological Resources. During on-site construction and installation of the Outrigger Telescopes about 0.008 ha (0.019 ac) of Wēkiu bug habitat would be displaced. The project, as proposed, calls for a minimum habitat restoration at a ratio of at least 3:1.

The adverse impact after mitigation would be small. The proposal also specifies continued Wēkiu bug monitoring and funding for an autecology study. There is a potential for small impact during operation of the Outrigger Telescopes.

From a cumulative perspective, the impact of past, present, and reasonably foreseeable future activities on biological resources on Mauna Kea is substantial and adverse. The addition of the Outrigger Telescopes would have a small incremental impact. Further, on balance, the impact from the Outrigger Telescopes Project is likely to be beneficial as a result of Wēkiu bug habitat restoration and the autecology study.

Hydrology, Water Quality, and Wastewater. No impacts would be expected to occur to hydrology and/or water quality during on-site construction and installation of the Outrigger Telescopes. There would be no impacts to Lake Waiau. In addition, there would be no impact during the operation of the Outrigger Telescopes.

From a cumulative perspective, the impact of all past, present, and reasonably foreseeable future astronomy-related activities, including the incremental impact of the Outrigger Telescopes Project, on the hydrologic system is negligible. Therefore, the cumulative impact on hydrology and water quality is not significant.

Solid Waste and Hazardous Materials Management. With appropriate handling of solid waste and hazardous materials, no impacts are anticipated during the on-site construction and installation of the Outrigger Telescopes. No impact would occur during the operation of the Outrigger Telescopes.

From a cumulative perspective, the impact of solid waste on biological resources, water quality, and aesthetics from past, present, and reasonably foreseeable activities is small, if any, transient, and not significant. The incremental impact of the Outrigger Telescopes Project would therefore be small and not significant.

The impacts of hazardous materials on biological resources, water quality, and aesthetics from past, present, and reasonably foreseeable activities are small and not significant. The incremental impact of the Outrigger Telescopes Project would therefore be small and not significant.

Geology, Soils, and Slope Stability. The on-site construction and installation of the Outrigger Telescopes would result in small and not significant impacts to soils and slope stability. These impacts would be minimized through best management construction practices and use of retaining walls. No impact would occur during the operation of the Outrigger Telescopes.

From a cumulative perspective, the impact of past and present activities on geology, soils, and slope stability has been substantial. The impact of foreseeable future activities is anticipated to be small. The Outrigger Telescopes would add a small and not significant incremental impact. The overall cumulative impact is significant.

Land Use and Existing Activities. The on-site construction and installation of the Outrigger Telescopes would have no impact on the current land use designation. In addition, this phase of the project would have no long-term conflict with or substantial impact on existing activities. The operation of the Outrigger Telescopes would have no

impact on the current land use designation. The operation of the Outrigger Telescopes would have no substantial impact on existing activities.

From a cumulative perspective, most past, present, and reasonably foreseeable future activities on Mauna Kea are consistent with State and local plans and compatible with State land use designations. The Outrigger Telescopes Project would have no incremental impact on land use.

The impacts of past, present, and reasonably foreseeable future activities on existing activities on Mauna Kea are substantial. The addition of the Outrigger Telescopes to the existing observatories on the mountain would have a small incremental impact.

Transportation. The on-site construction and installation of the Outrigger Telescopes would result in short-term minor impacts. The slight increase in traffic during the operation of the Outrigger Telescopes would create a very small impact.

From a cumulative perspective, the impact from past, present, and reasonably foreseeable future activities on transportation on Mauna Kea is significant. The addition of the Outrigger Telescopes to the existing observatories on the mountain would have a small incremental impact on transportation.

Utilities and Services. The capabilities of the existing utilities and services would accommodate any needs during the on-site construction and installation of the Outrigger Telescopes. The existing facilities and services would accommodate the minimal increases during the operation of the Outrigger Telescopes.

From a cumulative perspective, the past, present, and reasonably foreseeable future activities on Mauna Kea have led to the development of a water supply system, which constitutes a substantial impact on water supply. The water usage and traffic associated with water delivery are small and not significant in comparison to overall island water usage and Mauna Kea Access Road traffic levels. The addition of the Outrigger Telescopes to the existing observatories on the mountain would have almost no incremental impact on water supply.

The past and present activities on Mauna Kea have led to the development of electrical power and communications infrastructure, which constitutes a substantial impact on such capability. Reasonably foreseeable future activities are anticipated to have a small additional impact on electrical power and communications. The Outrigger Telescopes Project would have no incremental impact on the existing electrical distribution and communications systems.

The past and present activities on Mauna Kea have led to the development of emergency services and fire suppression capability. It is anticipated that foreseeable future activities would require similar additional development. The addition of the Outrigger Telescopes to the existing observatories on the mountain would have no incremental impact on emergency services and fire suppression capabilities.

Socioeconomics. The on-site construction and installation of the Outrigger Telescopes would result in small increases in job opportunities and increased revenues to the State

and County economies. The operation of the Outrigger Telescopes would result in a small positive impact on the State and County economies.

From a cumulative perspective, the impact of past, present, and reasonably foreseeable future activities within the Astronomy Precinct on socioeconomics is substantially positive. The Outrigger Telescopes Project would add a small positive increment to this impact. The overall cumulative impact on socioeconomics is substantial and positive.

Air Quality. The expected emissions from the on-site construction and installation of the Outrigger Telescopes, including localized fugitive dust and exhaust emissions, would remain below the significance threshold for particulate and combustion emissions. Overall, the adverse impact would be small. No impact would result during the operation of the Outrigger Telescopes.

From a cumulative perspective, the impacts to air quality are small. The Outrigger Telescopes Project would employ mitigation measures as discussed in Section 4.1.10.2 of the Final EIS and would have a very small incremental impact on air quality.

Noise. The on-site construction and installation of the Outrigger Telescopes would result in intermittent, short-term noise increases which would create a moderate impact. No impact would occur during the operation of the Outrigger Telescopes.

Visual/Aesthetics. The on-site construction and installation of the Outrigger Telescopes would result in temporary visual intrusion to the cultural landscape due to construction activities and presence of heavy equipment and materials. Visual impact would be greatest within the Astronomy Precinct, but at times would be visible from certain off-mountain areas. The Outrigger Telescopes would be visible during operation from most locations within the Astronomy Precinct. Below the summit area, the mountain topography would determine visual impacts. Where visible, the visual impact would be small compared to the impact of the much larger Keck Telescopes domes.

From a cumulative perspective, impact from past, present, and reasonably foreseeable future activities is substantial. Future visual impacts may be minimized by new design guidelines and careful site selection of new development projects. Mitigating dust generation, enforcing strict trash control, and minimizing on-site staging areas would reduce local short-term visual impacts. The Outrigger Telescopes Project would add a small incremental visual impact.

In summary, from a cumulative perspective, the impact of past, present, and reasonably foreseeable future activities on cultural and biological resources is substantial, adverse, and significant. The corresponding impact on socioeconomics is substantial and positive. In general, the Outrigger Telescopes Project would add a small incremental impact. Overall, past, present, and reasonably foreseeable future activities have a significant impact on the quality of the human environment.

B) Gran Telescopio de Canarias (GTC)

Any Federal action at the GTC site needs to comply with Executive Order 12114, Environmental Effects Abroad of Major Federal Actions, rather than NEPA. However, a

sound NEPA type analysis was applied to this alternative to truly compare this site with the Mauna Kea site.

Cultural Resources. No group considers the area of the ORM to be sacred or of religious importance. There are a number of discovered archaeological sites within the ORM. Minor impacts would be expected during the on-site construction and installation of the Outrigger Telescopes. The operation of the Outrigger Telescopes would result in no impact on traditional cultural practices. In addition, there would be no potential for adverse effects on archaeological resources.

Biological Resources. The impact on flora and fauna during the on-site construction and installation of the Outrigger Telescopes would be minor. A major portion of the site has already been disturbed by GTC construction. The impacts on fauna would be temporary, while it could take some period of time for flora to reestablish itself. There would be no impacts to sensitive species. The operation of the Outrigger Telescopes would have no impact.

Hydrology, Water Quality, and Waste Water. Construction activities may affect precipitation run-off from the site. The impacts to hydrology and water quality would be small. No water channels or drainages cross the site. The overall impact of the operation of the Outrigger Telescopes would be effectively zero.

Solid Waste and Hazardous Materials Management. With appropriate handling of solid waste and hazardous materials, there would be effectively no impacts arising from solid waste and hazardous materials during the on-site construction and installation of the Outrigger Telescopes. In addition, no impact would result from the operation of the Outrigger Telescopes.

Geology, Soils, and Slope Stability. The site is on an 18 percent slope. With available mitigation methods the adverse impacts from the on-site construction and installation of the Outrigger Telescopes are anticipated to be small. No adverse impact would result from the operation of the Outrigger Telescopes.

Land Use and Existing Activities. The on-site construction and installation of the Outrigger Telescopes would be consistent with designated uses within the ORM and would have no impact. The operation of the Outrigger Telescopes would be consistent with the only use of any note, astronomy, in the vicinity of the ORM. Visitors travel to ORM primarily to see the observatories. The operation of the Outrigger Telescopes would have no impact.

Transportation. The impact of the on-site construction and installation of the Outrigger Telescopes would be small and less than at Mauna Kea. The operation of the Outrigger Telescopes would result in nearly zero impact.

Utilities and Services. The existing facilities and services would accommodate the small increases during the operation of the Outrigger Telescopes. Except for electric utilities, increases during the operation of the Outrigger Telescopes would be minimal and would be accommodated by existing facilities and services. The operation of the Outrigger Telescopes would result in substantial impacts to electric power supply unless facilities are upgraded; with upgrades adverse impacts would be small.

Socioeconomics. The on-site construction and installation of the Outrigger Telescopes would result in a moderate benefit to La Palma and a small benefit to the Canary Islands. The operation of the Outrigger Telescopes would create small additional revenues to La Palma and the Canary Islands.

Air Quality. The adverse impacts from the on-site construction and installation of the Outrigger Telescopes would be expected to be small and slightly less than for the W.M. Keck Observatory site. The operation of the Outrigger Telescopes would result in no impact.

Noise. The impacts from the on-site construction and installation of the Outrigger Telescopes would be small and less than at Mauna Kea. The operation of the Outrigger Telescopes would result in no impact.

Visual/Aesthetics. There would be no impact as a result of the on-site construction, installation, and operation of the Outrigger Telescopes.

C) No-Action

Under the No-Action Alternative, the potential environmental impacts described for the Outrigger Telescopes Project would not occur. If the Outrigger Telescopes are not constructed and installed at the W.M. Keck Observatory on Mauna Kea, the facilities at the W.M. Keck Observatory site would consist of the two existing 10-m (33-ft) Keck Telescopes, which are capable of functioning as the Keck-Keck Interferometer. NASA would not be able to attain the four science objectives of the Outrigger Telescopes Project discussed in Section 1.2 of the Final EIS. In addition, the No-Action Alternative would result in economic losses to the State of Hawai'i estimated at $13 million for the on-site construction and installation of six Outrigger Telescopes. The incremental revenues ($5 to $7 million annually) that would be associated with operation of the Outrigger Telescopes Project would also be lost to the State. NASA's funding of the Wēkiu bug on-site mitigation, the autecology study, and the Wēkiu bug monitoring activities would not occur. NASA's funding of the on- and off-site mitigation activities proposed by NASA in the NHPA Section 106 process would also not occur.

The environmental impacts attributed to the implementation of the Outrigger Telescopes Project would not occur. The impacts of past, present, and foreseeable future activities on Mauna Kea would be unchanged (see Section 4.2 of the Final EIS). Since the incremental impacts of the Outrigger Telescopes Project would be generally small, the overall cumulative impacts would generally be as described in Section 4.2 of the Final EIS.

D) Reduced Science Option

Mount Wilson Observatory

Cultural Resources. On-site construction and installation of the Outrigger Telescopes is not likely to adversely impact any cultural or archaeological resources. Operation of the Outrigger Telescopes would not impact cultural or historic resources within the project area.

Biological Resources. On-site construction and installation of the Outrigger Telescopes would require the removal of trees in the immediate vicinity of the dome enclosures and combiner facility and along the access trail to the site. No substantial biological impacts would occur as a result of operating the Outrigger Telescopes.

Hydrology, Water Quality, and Wastewater. No impacts would be expected to occur to hydrology and/or water quality as a result of the on-site construction and installation of the Outrigger Telescopes. Operation of the Outrigger Telescopes could potentially adversely impact wastewater operations.

Solid Waste and Hazardous Materials Management. The on-site construction, installation, and operation of the Outrigger Telescopes should have little or no impact on solid waste or hazardous materials management, given that best management practices are followed.

Geology, Soils, and Slope Stability. On-site construction and installation of the Outrigger Telescopes would have a small impact on geology and soils at the site. There would be no geology, soils, or slope stability impacts associated with operation of the Outrigger Telescopes.

Land Use and Existing Activities. It is anticipated that there would be no land use impact associated with the on-site construction, installation, and operation of the Outrigger Telescopes. It is also anticipated that the on-site construction and installation of the Outrigger Telescopes would not result in a long-term conflict with or have a substantial impact on existing activities. The impacts on existing activities associated with the operation of the Outrigger Telescopes would be small, limited to the visual presence of the telescope enclosures.

Transportation. The on-site construction and installation of the Outrigger Telescopes would result in short-term minor impacts. The slight increase in traffic during the operation of the Outrigger Telescopes would create a small impact.

Utilities and Services. The capabilities of the existing utilities and services would accommodate any needs during the on-site construction and installation of the Outrigger Telescopes. Because of the limited amount of potable water on site, a new well and storage tank may be required during the operation of the Outrigger Telescopes. In addition, the operation of the Outrigger Telescopes could have a substantial impact on the existing electrical and communications supply systems.

Socioeconomics. The on-site construction and installation of the Outrigger Telescopes would likely result in a moderate beneficial impact to nearby local communities. It is anticipated that operation of the Outrigger Telescopes would have minimal long-term positive impacts on local/regional socioeconomics.

Air Quality. The on-site construction and installation of the Outrigger Telescopes would result in a small adverse impact on ambient air quality. No impact would result from the operation of the Outrigger Telescopes.

Noise. The on-site construction and installation of the Outrigger Telescopes would result in intermittent, short-term noise increases which would create a moderate impact. There would be no impact from the operation of the Outrigger Telescopes.

Visual/Aesthetics. Operation of the Outrigger Telescopes would have a small incremental impact on visual resources from the view plane on the summit. The Outrigger Telescopes would not be seen below the mountain.

Cumulative Impacts. There are no known plans for construction and operation of any additional telescopes at the MWO site for the foreseeable future. On-site construction, installation, and operation of the Outrigger Telescopes at the MWO site would have little incremental impact on the whole. From an environmental impact perspective, construction of the Outrigger Telescopes would not combine with past and present sources of environmental impact sufficient to result in exceedances of existing environmental standards, either Federal or State. Operation of the Outrigger Telescopes may incrementally impact the existing wastewater treatment system at MWO and possibly even the current MWO potable water supply capability.

Palomar Observatory

Cultural Resources. On-site construction and installation of the Outrigger Telescopes would likely have no impact on cultural resources. Operation of the Outrigger Telescopes would have minimal impact on cultural resources.

Biological Resources. The on-site construction and installation of the Outrigger Telescopes would require the removal of trees in the immediate vicinity of the dome enclosures. No biological impacts would occur during the operation of the Outrigger Telescopes.

Hydrology, Water Quality, and Wastewater. Small impacts from controlled surface runoff would be expected to occur during the on-site construction and installation of the Outrigger Telescopes. No substantial impact would occur during the operation of the Outrigger Telescopes.

Solid Waste and Hazardous Materials Management. The on-site construction, installation, and operation of the Outrigger Telescopes should have little or no impact on solid waste or hazardous materials management, given that best management practices are followed.

Geology, Soils, and Slope Stability. On-site construction and installation of the Outrigger Telescopes would have a small impact on geology and soils at the site. There would be no geology, soils, or slope stability impacts associated with operation of the Outrigger Telescopes.

Land Use and Existing Activities. It is anticipated that there would be no land use impact associated with the on-site construction, installation, and operation of the Outrigger Telescopes. It is also anticipated that the on-site construction and installation of the Outrigger Telescopes would not result in a long-term conflict with or have a substantial impact on existing activities. The impacts on existing activities associated with the

operation of the Outrigger Telescopes would be small, limited to the visual presence of the telescope enclosures.

Transportation. The on-site construction and installation of the Outrigger Telescopes would result in short-term minor impacts. The slight increase in traffic during the operation of the Outrigger Telescopes would create a small impact.

Utilities and Services. There would be no impact on existing utilities and services resulting from the on-site construction and installation of the Outrigger Telescopes. Additional electrical power needed to operate the Outrigger Telescopes could be made available with the installation of another transformer. Water consumption during drought periods could be a significant operations consideration. All other needs resulting from the operation of the Outrigger Telescopes would be minimal and accommodated by existing facilities.

Socioeconomics. The on-site construction and installation of the Outrigger Telescopes would likely result in a moderate beneficial impact to nearby local communities. It is anticipated that operation of the Outrigger Telescopes would have minimal long-term positive impacts on local/regional socioeconomics.

Air Quality. The on-site construction and installation of the Outrigger Telescopes would result in a small adverse impact on ambient air quality. No impact would result from the operation of the Outrigger Telescopes.

Noise. The on-site construction and installation of the Outrigger Telescopes would result in intermittent, short-term noise increases which would create a moderate impact. There would be no impact from the operation of the Outrigger Telescopes.

Visual/Aesthetics. The on-site construction and installation of the Outrigger Telescopes could create temporary visual impacts for some viewers. The long-term visual impact of the Outrigger Telescopes would depend on the exact Telescope site selected and vantage point of the viewer. The Outrigger Telescope enclosures would be less prominent visually than the existing Hale facility.

Cumulative Impacts. There are no known plans for the construction and operation of any additional telescopes at the Palomar Observatory site for the foreseeable future. On-site construction, installation, and operation of the Outrigger Telescopes at the Palomar Observatory site would have little incremental impact on the whole. From an environmental impact perspective, construction of the Outrigger Telescopes would not combine with past and present sources of environmental impact sufficient to result in exceedances of existing environmental standards, either Federal or State. Operation of the Outrigger Telescopes may incrementally impact the existing potable water supply system at the Palomar Observatory.

C. ASSESSMENT OF THE ANALYSIS

Incomplete and Unavailable Information

Incomplete or unavailable information described in the Final EIS include the lack of detailed project plans for reasonably foreseeable future activities and the population dynamics of the Wēkiu bug. NASA used the best information available as of the writing

of the Final EIS to describe reasonably foreseeable future activities and knowledge of Wēkiu bug behaviors. The incomplete or unavailable information is not essential in making a reasoned choice among the alternatives. In addition, the current Wēkiu bug monitoring and mitigation planning as well as the restoration efforts will likely increase the knowledge of the bug and its habitat.

Programmatic and Technical Considerations

My choice of a site for the Outrigger Telescopes Project is based in part on the following programmatic and technical considerations which were elements of the *Tier 2* screening criteria.

No alternate site matches the scientific capability of the W.M. Keck Observatory on Mauna Kea, which hosts the world's two largest and most powerful optical telescopes. The W.M. Keck Observatory is found to offer the highest overall scientific potential, as well as the lowest technical and programmatic risk.

The Mauna Kea site is one of the finest locations in the world for ground-based astronomical observations. The atmosphere above the mountain is generally cloud-free; Mauna Kea has one of the highest number of clear nights per year (approximately 300) in the world. In addition, the atmosphere is exceptionally dry. This is important because water vapor absorbs light in the infrared portion of the spectrum, wavelengths at which the Outrigger Telescopes would operate.

Further, the atmosphere at Mauna Kea is free from disturbance caused by neighboring landforms. It is therefore more stable than the atmosphere at most other observatory sites, allowing more detailed observations (better astronomical "seeing") than elsewhere. The seeing at Mauna Kea is generally 0.5 arcseconds or better, i.e., the stellar image size is generally 0.5 arcseconds or smaller. The summit's height above the tropical inversion layer also provides conditions that are free from atmospheric pollutants and exceptionally dry, *i.e.*, low atmospheric water vapor.

There is sufficient available land at the Keck site to accommodate the baselines required for the Outrigger Array. In addition, NASA has an established relationship with CARA whereby NASA receives observing time on both 10-m (33-ft) telescopes. Implementation of the Outrigger Telescopes Project at the W.M. Keck Observatory would be low risk.

The GTC in the Canary Islands, Spain, is found to be a reasonable alternate site, although it would offer only a single 10-m (33-ft) telescope, has higher atmospheric water vapor, and would carry some programmatic risk.

There appears to be sufficient available land at the GTC site to accommodate the baselines required for the Outrigger Array. The sloping topography of the GTC site poses some challenges, but does not preclude the installation of the Outrigger Telescopes.

The GTC site is generally regarded as having superior astronomical seeing, although substantially poorer seeing than at the Mauna Kea site. The seeing at the GTC site is estimated to be approximately 0.7 arcseconds, with approximately 79 percent of nights

being suitable for observing. The amount of water vapor above the site is low-to-moderate, corresponding to the site's intermediate 2,400-m (7,900-ft) altitude.

Discussions with representatives of the Instituto de Astrofísica de Canarias indicate that 70 percent of available observing time on the GTC has been committed to Spain, 5 percent to Mexico, and 5 percent to the University of Florida, leaving approximately 20 percent uncommitted at this time.

Assuming that the GTC collaboration found it in their programmatic interest to host the Outrigger Array, it is possible that NASA could successfully negotiate for a fraction of the uncommitted observing time. It is not known what other financial or programmatic arrangements might be required of NASA in return for access to the GTC. According to sources within the Instituto de Astrofísica de Canarias, Spain has applied to become a member of the European Southern Observatory (ESO). What effect ESO membership might have on available observing time or on NASA's prospects for negotiating access to the GTC is not known.

The choice to continue preparations for and to fund the Outrigger Telescopes Project is fully consistent with the mandate of the National Aeronautics and Space Act to contribute to the expansion of human knowledge of phenomena in space.

Environmental Considerations

The best available environmental information for the GTC site suggests there are no known endangered or threatened species. There are no cultural resource issues associated with the GTC site. Water supply and disposal appear to be potentially sensitive issues for the site, but are expected to be manageable.

If the GTC site were selected, the economic and employment opportunities associated with the on-site construction, installation, and operation of the Outrigger Telescopes would benefit the Canary Islands and Spain, rather than the State of Hawai'i and the United States of America.

Overall, the GTC site is the environmentally preferable alternative.

Choice of Alternatives

On the basis of the above programmatic, technical, and environmental considerations and other factors, it is my intention to select the Mauna Kea site.

The Mauna Kea site offers the greatest science capability for both astrometry and imaging, and provides the strongest support to the Origins program. The atmospheric seeing quality (0.5 arcseconds or better) is significantly better than at the alternative site. In addition, the Mauna Kea site offers two 10-m (33-ft) telescopes whereas the Canary Islands site offers only one—the GTC—essentially a copy of the Keck 10-m (33-ft) telescope. Two telescopes provide greater light gathering power and therefore higher sensitivity. Two telescopes offer a larger number of baseline combinations with the Outrigger Telescopes, resulting in better directional coverage and therefore improved imaging performance, particularly for complex sources. At Mauna Kea's summit altitude of 4,205 m (13,796 ft) above sea level (almost twice the altitude of the Canary Islands alternative), atmospheric water absorption at infrared wavelengths is less pronounced,

particularly at mid-infrared wavelengths important for imaging. The W.M. Keck Observatory is a mature operational facility with existing interferometry infrastructure associated with the Keck-Keck Interferometer, making this the lowest cost and lowest risk approach.

Further, both the Canary Islands site and the GTC telescope are foreign-owned. It is not known whether NASA could successfully negotiate for time on the GTC (currently 20% of observing time remains unallocated and NASA would need 50 to 100% of this), or what financial contribution or other arrangements might be required to gain access to the site. The GTC is currently under construction, and it is estimated that it will not become operational until 2007 at the earliest. Delays in completing the GTC and bringing it into operation would further delay the Outrigger Telescopes Project. It is not clear that the GTC will initially include an adaptive optics capability (required for interferometry), and therefore such a system may have to be developed at NASA's expense. The atmospheric seeing at La Palma is not as good as Mauna Kea and would require the addition of adaptive optics to the Outrigger Telescopes. This would place limiting magnitude restrictions on astronomical target selection, reducing the number of young stellar objects available for imaging, for example, by a factor of about six. The Canary Islands are considerably more remote from California than is Hawai'i. This might pose added complications in deploying key personnel from the Jet Propulsion Laboratory and the Michelson Science Center for extended periods of time, as some of these personnel would also be required at Mauna Kea to complete and operate the Keck-Keck Interferometer. Language differences would also be expected to affect implementation efficiency.

NASA has committed to ensuring that extensive mitigation measures (summarized in Section E below and in Chapter 5 of the EIS) would be carried out if the Outrigger Telescopes Project is implemented at the Mauna Kea site. In part as a result, the Outrigger Telescopes Project would add only a small incremental impact to the environmental and cultural resource impacts resulting from other activities—past, present, and reasonably foreseeable future--on Mauna Kea.

In evaluating all of the above considerations, I conclude that the combination of factors favoring the Mauna Kea site outweigh the relative environmental and cultural resource advantages of the GTC site.

D. ADDITIONAL INFORMATION

Section 106 Consultation

In addition to its NEPA activities, NASA conducted consultations in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended (NHPA) (16 U.S.C. § 470 *et seq.*). NASA began this process in July 1999 by authorizing UH to begin working-level consultations on behalf of NASA. UH, in consultation with the Hawai'i State Historic Preservation Division (SHPD), contacted a number of Native Hawaiian organizations to determine their interest in participating in the Section 106 process. In November 1999, a NASA representative met with the Hawai'i Island Burial Council. In

August 2000, NASA formally provided copies of draft mitigation proposals to the State Office of Hawaiian Affairs (OHA), the Royal Order of Kamehameha I (ROOK I), the Hawai'i Island Burial Council, and Hui Mālama I Nā Kūpuna O Hawai'i Nei, and invited them to join with NASA and the SHPD in formal consultation under the Section 106 process as Consulting Parties. In September 2000, NASA formally invited the Advisory Council on Historic Preservation (ACHP) to join in the Section 106 process. The ACHP agreed to participate.

NASA consulted with and invited the Office of Mauna Kea Management (OMKM), the Mauna Kea Management Board, and Kahu Kū Mauna Council to participate in developing a Memorandum of Agreement (MOA) under Section 106. Two more Native Hawaiian organizations, Ahahui Kū Mauna and Mauna Kea Anaina Hou, requested and were given Consulting Party status. NASA held formal Section 106 meetings in Hilo on February 1, 2001, and again on January 16 and 17, 2002. NASA completed the Section 106 consultation process on February 22, 2002, with the signing of an MOA by NASA, ACHP, SHPD, CARA, Caltech, UH, and Ahahui Kū Mauna (with caveat). The MOA is provided in Appendix B of the Final EIS for completeness.

Wēkiu Bug

The Wēkiu bug is a candidate for listing under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*). NASA and its contractor proactively sought informal conferral with the United States Fish and Wildlife Service and spoke with other independent entomologists to determine adequate protocols for reducing potential impacts to the bug and its habitat. If the Outrigger Telescopes are constructed, installed, and operated at the W.M. Keck Observatory, NASA will provide funding to perform a Wēkiu bug autecology study to gather information about habitat requirements, life cycle, nutritional requirements, and breeding behaviors of this unique bug. NASA will ensure that CARA will adhere to the mitigation measures noted in Section E of this Record of Decision.

Religious Practices Consultation

As stated in Section 3.1.2.5 of the Final EIS, NASA was able to consult with several contemporary religious practitioners who continue to perform religious observances on Mauna Kea. These practitioners find that the presence of the observatory domes on the summit, and the noise emanating from them and created by the vehicular traffic, destroys the silence and spiritual ambience that is necessary to their proper religious observances.

E. MITIGATION

The mitigation and monitoring measures for the Outrigger Telescopes Project are detailed in Chapter 4 and Appendices B, D, E, and F of the Final EIS. Many of these measures are also summarized in Chapter 5 of the Final EIS. The mitigation measures discussed below are not exhaustive. Rather they highlight important aspects of the mitigation. The NHPA Section 106 MOA in Appendix B describes the mitigation and monitoring measures associated with historical and cultural resources.

Appendices D and E of the Final EIS describe mitigation and monitoring measures associated with the Wēkiu bug and its habitat. CARA would ensure that any of the

MOA's provisions that relate to on-site construction and installation of the Outrigger Telescopes would be included as provisions in any contracts for on-site construction and installation. See Appendix F (Construction Best Management Practices Plan) of the Final EIS for additional information.

CARA would implement all of these mitigation measures, and NASA would ensure they were carried out during on-site construction, installation, and operation of the Outrigger Telescopes. In addition, NASA would ensure compliance with conditions imposed on the Project through the State of Hawaii permitting and approval process. In any case where Project mitigation and monitoring measures differed from conditions imposed through the State of Hawaii permitting and approval process, NASA would ensure compliance with the State-imposed conditions.

Historic/Cultural Resource Mitigation and Monitoring Measures

- In consultation with NASA and the other Consulting Parties, CARA shall develop criteria for and select an individual to be the project's Cultural Monitor. Any Consulting Party may submit the names of persons who they believe would be appropriate to serve as Cultural Monitor. This individual will have the knowledge or awareness of Mauna Kea's cultural landscape, and traditions, practices, beliefs, and customs associated with Mauna Kea.

- The Cultural Monitor will be able to communicate cultural values and protocols to others, both within and outside of the culture.

- The Cultural Monitor will become aware of the general scope and requirements of the on-site construction and installation of the Outrigger Telescopes Project including, but not limited to, becoming familiar with: project boundaries, identified areas of historic/cultural sensitivity, the "Construction Best Management Practices Plan" (BMP), the construction worker responsibilities, responsibilities of the Archaeologist, and the sequence of operations to ensure that mitigation actions are implemented.

- The Cultural Monitor will be provided free access for monitoring activities during excavation, other on-site construction, and telescope installation.

- Prior to construction, a cultural monitoring plan will be developed by the Cultural Monitor in consultation with CARA. CARA shall submit the plan for review by NASA and all other Consulting Parties.

- The CARA Construction Manager shall encourage the Cultural Monitor and Archaeologist to work closely with one another.

- The CARA Construction Manager will provide to the Cultural Monitor a weekly schedule of all construction activities planned for the following week. Based on that schedule, the Cultural Monitor will determine his/her need to visit the site during construction and installation as deemed necessary by him/her. For safety purposes, prior to entering the site, the Cultural Monitor will meet and confer with the CARA Construction Manager.

- The site and grading development drawings and the BMP for the Outrigger Telescopes project site, the staging areas, and nearby areas of the summit region will

be provided to the Cultural Monitor. The Cultural Monitor shall keep a log and map notes of every visit — noting date of visit; identifying work locations; noting findings date; and reporting on potential problems, if any. All findings identified and deemed to be significant by the Cultural Monitor shall be reported to the CARA Construction Manager and OMKM; in turn, CARA shall promptly notify NASA, the Advisory Council, the State Historic Preservation Officer (SHPO), UH, and Caltech and any other Consulting Party that has requested to be notified of the Cultural Monitor's findings. The Cultural Monitor will submit a final report to the CARA Construction Manager; CARA, in turn, will provide copies to NASA, the Council, the Hawai'i SHPO, UH, OMKM, and Caltech and any other Consulting Party that has requested the report.

- The Cultural Monitor shall consult with the Construction Manager to determine under what circumstances the Cultural Monitor should have direct authority to halt construction activities in a given area.

- The Cultural Monitor will provide cultural orientation to individuals who are associated with the on-site construction and installation of the Outrigger Telescopes and who will be on Mauna Kea. For safety purposes, all communication for the purpose of cultural orientation between project personnel and the Cultural Monitor will be scheduled and overseen by the CARA Construction Manager.

- The Archaeologist will be hired by CARA in consultation with the Hawai'i SHPO and OMKM.

- The above cultural monitoring plan shall include burial and notification components that comply with Hawai'i Revised Statutes (HRS) Title 6E-43.6 (Inadvertent Discovery of Burial Sites), and Hawai'i Administrative Rules (HAR) Title 13-300-40 (Inadvertent Discovery of Human Remains) for the burial components; and with applicable draft SHPD Rules (*e.g.*, Sections 13-275-12, 13-279-1 *et seq.*, and 13-280-1 *et seq.*) for the archaeological components. The burial treatment component will reflect that the preferred treatment, in the absence of evidence to the contrary, and to the extent practicable, is for any human burial found to remain in place. The burial and notification components of the cultural monitoring plan have been reviewed by the Hawai'i Island Burial Council]

- As a minimum, if there were to be an inadvertent discovery of human remains, or an archaeological property, the Archaeologist has the authority to halt ground-disturbing activities in the immediate area of such remains or archaeological property until all parties identified in the plan have been notified, and the requirements of the appropriately approved plan have been carried out.

- As a minimum, if previously unidentified historic properties (*e.g.*, deposits, artifacts, and stone alignments) were to be discovered during construction, the Archaeologist has the authority to halt ground disturbing activities in the immediate area of such properties until all parties identified in the plan have been notified, and the requirements of the appropriately approved plan have been carried out.

- The Archaeologist shall familiarize him/herself with the W.M. Keck Observatory site before construction begins.

- The Archaeologist will become aware of the general scope and requirements for the on-site construction of the Outrigger Telescopes Project. This would include, but not be limited to becoming familiar with: project boundaries, identified areas of historic/cultural sensitivity, the BMP, construction worker responsibilities, responsibilities of the Cultural Monitor, and the sequence of operations to ensure that mitigation actions are implemented.

- The Archaeologist will monitor all excavation activities for on-site construction. The CARA Construction Manager will provide to the Archaeologist a weekly schedule of all construction activities planned for the following week. The Archaeologist will have access to the site and be present during all excavation activities. For safety purposes, prior to entering the site, the Archaeologist will meet and confer with the CARA Construction Manager.

- The site and grading development drawings and the BMP for the Outrigger Telescopes project site, the staging areas, and nearby areas of the summit region will be provided to the Archaeologist. The Archaeologist shall keep a log and map notes of every visit — noting date of visit; identifying work locations; noting findings date; and reporting potential problems, if any. All findings identified and deemed by the Archaeologist to be significant shall be reported to the CARA Construction Manager, the Hawai'i SHPO, and OMKM; in turn, CARA shall promptly notify the NASA, the Council, UH, Caltech, and the Cultural Monitor of the Archaeologist's findings. The Archaeologist will also notify the Cultural Monitor if a burial is involved so that he or she can assist in coordinating with lineal and cultural descendents and the Hawai'i Island Burial Council. The Archaeologist will submit a draft report to the CARA Construction Manager; CARA, in turn, will forward the draft report to the Hawai'i SHPO for approval. The approved final report will be distributed by CARA, who will provide copies to NASA, the Council, UH, OMKM, and Caltech, and any other Consulting Party that has requested a copy of the report.

- Proposed grading and site development drawings will be provided to all the Consulting Parties for a 45-calendar day review and comment period to ensure that every reasonable effort has been made to reduce the adverse effects on Pu'u Hau 'Oki and on the summit region of Mauna Kea by minimizing disturbance from the on-site construction and installation of the Outrigger Telescopes. The goal of the grading and site development planning will be to minimize alteration of the cinder cone as it presently exists, maintain the general shape and form of the cinder cone as it presently exists, and to stabilize the cinder cone in the on-site construction and installation areas.

- When a Consulting Party provides comments to one of these plans, the party submitting the plan shall, to the extent practicable during a 45-day review period, enter into a dialogue with a commenter.

- The CARA Construction Manager will oversee the on-site professional personnel and all on-site construction and equipment installation. The CARA Construction

Manager will schedule mutually agreed upon meetings with the Archaeologist, Cultural Monitor, and OMKM, to ensure that work is being carried out according to applicable terms of the MOA. The CARA Construction Manager, at the request of the Archaeologist or the Cultural Monitor or on his/her own initiative, has the authority to stop construction if the stipulations in the MOA are not being complied with.

- As part of an orientation process to ensure work is carried out in as sensitive and respectful a manner as possible, the CARA Construction Manager, the contractor(s), foremen, and all construction workers involved in this Undertaking will be required to view a specially scripted training videotape reviewing the historic and sacred qualities of Mauna Kea.

- This training videotape will be prepared by CARA in consultation with the Hawai'i SHPO and OMKM. This training videotape will include a presentation on the history of Mauna Kea and its significance to Native Hawaiians, and an overview of what to do if human remains or archaeological properties are found. CARA shall provide the Consulting Parties an opportunity early in the videotape development process to provide ideas on subject matter that should be discussed and highlighted. CARA shall afford the Consulting Parties an opportunity to review the draft script and preview the videotape before the videotape is produced in final form. Should a disagreement arise, CARA will enter into consultation to resolve the disagreements. The time for such consultations shall cumulatively not exceed 45 days, unless CARA, at its sole discretion, agrees to a longer cumulative period.

- The CARA Construction Manager, contractor (s), foremen, and construction workers will also be briefed by the Archaeologist and Cultural Monitor on Native Hawaiian objects, artifacts, and remains, and what to do if such materials are found during construction activities.

- The videotape will also advise the workers of the potential loss of their jobs on this Undertaking if they fail to comply with the conditions imposed by the Construction Best Management Practices Plan.

- In order to implement a series of precautions and procedures to be undertaken to avoid or minimize adverse effects and prevent or reduce adverse impacts to the cinder cone and inner crater slope during on-site construction and installation, the CARA Construction Manager and the on-site construction and installation contractor(s) will prepare a BMP in consultation and coordination with OMKM and UH. The BMP will be finalized prior to the start of construction. This BMP will reference the MOA and include it as an appendix.

- Prior to the start of construction, CARA will submit the draft BMP to the Signatories and the Concurring Parties for review. Copies of all comments received will be provided to NASA. CARA will take those comments into account before its final approval of the BMP and prior to mobilization. CARA will take no more than 15 calendar days to conclude consultation on any issues stemming from the comments.

- On-site construction and installation activities related to the Outrigger Telescopes — from delivery of materials and equipment to the W.M. Keck Observatory site or one of the two construction staging areas, excavation and removal of excess cinder to the summit stockpile area through assembly of the domes and telescopes to clean up of the staging, stockpile and the W.M. Keck Observatory site — will be managed in accordance with the BMP. The CARA Construction Manager will be responsible for following the BMP.

- To address the effects on historic properties, the BMP will include, but not necessarily be limited to, the following items:

  - The process to be followed if there were to be an inadvertent discovery of human remains or archaeological properties.

  - Site characterization, including the locations of all construction and laydown/stockpile areas on the site, and temporary on-site fill material stockpiles.

  - The sequence of construction activities will be designed to minimize potential adverse effects on historic properties and to allow efficient scheduling of appropriate monitoring times.

  - The specific methods needed to protect the attributes of the historic properties within the project site, staging areas, and within the immediate vicinity of the project area will include, but are not limited to:

    - Installing a temporary silt fence along the crater rim to facilitate on-site containment of all material, including cinder, so that no such material will spill over the slope. A silt fence will be used whenever excavation occurs within six feet of the slope.

    - Transferring all excavated material, to the extent not necessary for backfill or Wēkiu bug habitat restoration, to other locations accessible from the established roads on the summit of Mauna Kea. These locations will be identified after consultation with the Hawai'i SHPO and OMKM prior to the start of construction.

    - Following all applicable County of Hawai'i and State Department of Health regulations concerning dust control which include, but is not limited to, suspending all dust-generating activities, securing equipment and materials during high winds and storms, minimizing dust by spraying with water or other environmentally-acceptable soil stabilizers whenever necessary, and, if needed, covering excavated material with a tarp which is anchored down.

    - Ensuring adherence to effective drainage and erosion control as provided for in the BMP.

    - Ensuring that precautions are adopted to prevent potential adverse effects on the historic properties arising from use of the staging areas near the summit of Mauna Kea and at Hale Pōhaku.

- Providing an organizational chart that identifies project personnel with the responsibility for maintaining the integrity of the historic properties and the historic district.

- To reduce the visual impact on the cinder cone and the historic district, all structures or portions thereof will be of colors designed to blend in with the surrounding terrain; provided, however, that such colors would not adversely affect the operation and scientific capability of the Outrigger Telescopes. CARA will afford the Consulting Parties an opportunity to review and comment on the colors to be used.

- Characteristics of any discharge of a pollutant into the environment associated with the construction activity (including solid waste, sanitary waste, oily waste, or toxic/hazardous waste, if any) will be identified as soon as it is practicable. Proposed control measures and/or treatment methods for any unplanned or accidental discharge of pollutants associated with construction activity will be developed by the contractor(s) and managed in accordance with the BMP.

- During the construction and installation of the Outrigger Telescopes, OMKM, in consultation with the Hawai'i SHPO, will develop and provide interpretative materials concerning the cultural significance of Mauna Kea.

- CARA shall report work stoppage to NASA and all the Consulting Parties within two working days.

- CARA shall make provisions for the Consulting Parties to monitor and review the work during on-site construction and installation activities. However, for safety purposes, all construction site visits must be coordinated through the CARA Construction Manager's office. If it appears that the terms of this MOA are not being followed, Consulting Parties are encouraged to notify NASA, CARA, and the Hawai'i SHPO.

- CARA will ensure that all persons involved with the operations of the Outrigger Telescopes shall be required, within a thirty day period of commencing their job, to view as part of worker orientation the training videotape which addresses the cultural significance of Mauna Kea to Native Hawaiians. CARA will report to OMKM quarterly on the status of worker compliance with the viewing of the training videotape.

- In order to minimize negative effects, appropriate traffic control measures will be taken, and all trips of heavy oversized loads, such as those transporting the telescope components, will be scheduled during off-peak hours so as not to interfere with normal traffic flow in Hilo, Waimea, or along the Saddle Road.

- CARA shall ensure that the plans and mitigation measures set forth in the MOA for adverse effects on historic properties, including, visual impacts, erosion control, permit requirements and conditions, and monitoring commitments are incorporated into the contract(s) with its contractors and subcontractors.

- NASA, in consultation with OMKM, will fund, out of funds for the Outrigger Telescopes Project, a $2 Million initiative that deals with preservation and protection

of historic/cultural resources on Mauna Kea and educational needs of Hawaiians as a mitigation component of the Outrigger Telescopes Project. Funding such an initiative, however, is conditioned on the approval and implementation of the Outrigger Telescope's being placed at the W.M. Keck Observatory site on the summit of Mauna Kea, Hawai'i. This initiative will be sensitive to Native Hawaiian culture, history, and institutions.

- The necessary first step is the formation of local citizens' working group. NASA and OMKM, in consultation with the other Consulting Parties will ensure the formation of this working group. OMKM will coordinate and manage the activities of this working group and provide administrative services.

- Once this working group is formed, its task will be to inform NASA as to what types of opportunities or goals will best benefit Hawaiians, including Native Hawaiians. The working group will be asked to prioritize their proposals.

- Funding will be subject to the availability of appropriated funds in accordance with Federal law (*e.g.*, the Anti-Deficiency Act). Such funds will be allocated to the proposals as prioritized by the working group until available funds are exhausted.

Wēkiu Bug Mitigation and Monitoring Measures

- Wēkiu bug habitat will be restored in areas damaged by on-site Outrigger Telescope construction, and on the crater floor of Pu'u Hau'oki. Restored areas will total at least three times the total area damaged by construction.

- Under no circumstances during construction, installation, and operation will cinder or other materials be deliberately side-cast into Wēkiu bug habitat. Temporary barriers will be built along the slope breaks above the inner slopes of Pu'u Hau'oki crater.

- Potable water will be applied to excavation sites and cinder stockpiles as required to minimize dust during earthmoving activities.

- Only small or contained areas will be affected at any given time.

- Dust-generating activities will be suspended during high winds.

- Application of environmentally safe soil stabilizers may be applied to roads and parking areas to reduce dust during and after on-site construction. Environmentally safe soil stabilizers would only be used in situations where the application of potable water is inadequate for dust control. Soil-binding stabilizers will be used sparingly, and will never be applied to Wēkiu bug habitat. Soil stabilizers will be applied under light wind conditions to prevent cinder dust drift due to wind into Wēkiu bug habitat. Products considered for use will be reviewed by an entomologist familiar with Wēkiu bug ecology prior to being considered for use.

- The W.M. Keck Observatory staff will continue to follow Federal guidelines specifying the use and disposal of substances used in the washing and recoating of observatory mirrors.

- Contractors will be required to minimize the amount of on-site paints, thinners, and solvents. Painting and construction equipment will not be cleaned on-site. Contractors will be required to keep a log of hazardous materials brought on-site and report spills immediately to a designated W.M. Keck Observatory representative.
- The amounts of such substances transported to the summit will be those required to support the current activity. The amount required for the entire project will not be stockpiled at the summit. Painting equipment would be cleaned off site to reduce the risk of a spill.
- Construction trash containers will be tightly covered to prevent construction wastes from being dispersed by wind.
- Construction materials stored at the site will be covered with tarps, or anchored in place, and not be susceptible to movement by wind.
- If construction materials and trash are blown into Wēkiu bug habitat, they will be collected to the extent practicable, with a minimum of disturbance to the habitat and cultural properties.
- Earthmoving equipment will be free of large deposits of soil, dirt, and vegetation debris that could harbor alien arthropods.
- Contractors will be required to pressure-wash earthmoving equipment to remove alien arthropods.
- Contractors will be required to inspect large trucks, tractors, and other heavy equipment before proceeding up the observatory access road.
- All construction materials, crates, shipping containers, packaging material, and observatory equipment will be free of alien arthropods when delivered to the summit.
- Contractors will be required to inspect shipping crates, containers, and packing materials before shipment to Hawai'i.
- Contractors will be required to inspect construction materials before transport to the summit area.
- Outdoor trash receptacles will be secured to the ground, have attached lids and plastic liners, and be collected frequently to reduce food availability for alien predators.
- New alien arthropod introductions (ants, yellow jackets, and spiders) detected during monitoring will be eradicated.
- Construction contracts will ensure that compliance violations are corrected.
- Cinder or ash will be moved to temporary stockpile areas and covered with tie-down tarps. Permanent placement of any excavated cinder fill and ash from the project area during on-site construction will be determined in consultation with SHPD and OMKM.
- Educational signs will be placed along the slope break above Wēkiu bug habitat, and at the service road adjacent to the crater floor. Attractive, non-intrusive, educational

signs will be installed to inform people about the Wēkiu bugs, their habitat, and the historic/cultural significance of the area.

- Two types of Wēkiu bug monitoring will be implemented: (1) compliance monitoring to investigate the extent to which contractors, operators, managers, and visitors comply with Wēkiu bug protection guidelines and rules; and (2) effectiveness monitoring to investigate the changes in Wēkiu bug habitat and population that may happen concurrent with and/or subsequent to construction of the Outrigger Telescopes.
- Strict adherence to precautions and procedures outlined in the BMP will be required to maintain slope stability.
- As part of project implementation, NASA will fund a study on Wēkiu bug autecology gather more information about habitat requirements, life cycle, nutritional requirements, and breeding behaviors.
- Contractors will properly maintain construction vehicles and equipment to minimize combustion emissions. Engine emissions would be controlled by the use of functional emission devices as required by law. Equipment idling would be kept to a minimum when not in use.

The mitigation measures incorporated as elements of the construction, installation, and operation of four, and ultimately up to six Outrigger Telescopes at the W.M. Keck Observatory site represent the practicable mitigation that could be adopted.

Monitoring and enforcement of the specified mitigation associated with implementing the W.M. Keck Observatory alternative would be accomplished in a number of ways. In the documents to provide funds to CARA to implement the project, NASA would require CARA to agree to implement relevant mitigation measures as a condition of funding. Similarly, CARA would insert language in agreements with contractors binding them to comply with mitigation measures applying to their activities.

The Section 106 MOA is enforceable by NASA, the Advisory Council on Historic Preservation, and Hawai'i State Historic Preservation Division. Alternatively, under the MOA, any of these parties can terminate the MOA and require reinitiation of the Section 106 process. During construction activities, the Archaeologist would be monitoring all excavation activities. Similarly, during construction and installation the Cultural Monitor would monitor activities to ensure they were conducted as agreed upon and in a culturally sensitive manner. Furthermore, each of the Consulting Parties (whether or not they signed the MOA) would have reasonable access to the site to monitor and report whether or not the mitigation measures were being carried out.

Construction and installation of the Outrigger Telescopes at the W.M. Keck Observatory site requires a Conservation District Use Permit issued by the Hawai'i Board of Land and Natural Resources (BLNR). To the extent that environmental mitigation measures are specified in the permit, they are enforceable by the BLNR. The BLNR has authority to monitor compliance and may authorize other parties (e.g., OMKM) also to play a monitoring role.

F. POST-FINAL EIS INPUT

In a letter dated March 4, 2005, the United States Environmental Protection Agency (EPA), Region 9 takes issue with the Final EIS and states generally that it continues "to be concerned with the cultural and habitat impacts from the project as proposed." EPA, Region 9 goes on to opine that: 1) environmental justice concerns have not been fully addressed; 2) an integrated planning approach should be used to determine the best overall use of the two million dollars that NASA is providing for mitigation; 3) OMKM should be involved in the selection and oversight of the cultural monitor and archaeologist; 4) the cultural monitor should have authority to halt construction activity; 5) there should continue to be dialogue with Native Hawaiian organizations throughout construction and operation of the project; and 6) ultra low-sulfur diesel fuel and particle traps be used for any construction after 2006. A copy of the EPA letter and NASA's specific responses to EPA's concerns are included as an attachment to this Record of Decision.

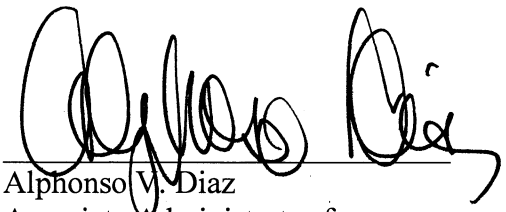
DECISION

Based upon all of the foregoing and the Final EIS and Section 106 MOA themselves, it is my decision to fund the on-site construction, installation, and operation of four, and possibly up to six, Outrigger Telescopes at the W.M. Keck Observatory within the Mauna Kea Science Reserve on the summit of Mauna Kea, island of Hawai'i. This is NASA's preferred alternative as described in the Final EIS for the Outrigger Telescopes Project issued on February 2, 2005. This decision is subject to the availability of funds.

As part of this decision, NASA will ensure that all specified mitigation and monitoring measures detailed in the Final EIS (including Appendices) will be carried out if the Outrigger Telescopes Project is implemented at the W.M. Keck Observatory site. In addition, NASA will ensure compliance with conditions imposed on the Project through the State of Hawaii permitting and approval process. In any case where Project mitigation and monitoring measures differ from conditions imposed through the State of Hawaii permitting and approval process, NASA will ensure compliance with the State-imposed conditions. Finally, through construction contracts entered into by CARA, NASA will ensure that ultra low-sulfur diesel fuel and particle traps are used for any Outrigger Telescopes Project construction after 2006, provided that such fuel is reasonably available on the island of Hawai'i.

If, for whatever reason, construction, installation, and operation of the Outrigger Telescopes at the W.M. Keck Observatory site does not proceed, I find that the GTC site in the Canary Islands, Spain is an environmentally acceptable alternative. Consequently, NASA would be free to pursue locating four to six Outrigger Telescopes at that site. Although the two Reduced Science Option sites (i.e., the Mount Wilson and Mount Palomar, California sites) would only satisfy Objective 3 of NASA's six ground-based interferometry science objectives, I find that construction, installation, and operation of four Outrigger Telescopes at either of these two sites would not have a significant impact on the quality of the human environment. Therefore, if the Project does not proceed at the W.M. Keck Observatory site for any reason, NASA may also pursue locating four

Outrigger Telescopes at either Mount Wilson or Mount Palomar. NASA also reserves the right not to proceed with the Outrigger Telescopes Project at any site, i.e., the No-Action Alternative.



7/22/05

Alphonso V. Diaz
Associate Administrator for
Science Mission Directorate

Date

ATTACHMENT

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

March 4, 2005

Dr. Carl B. Pilcher
Universe Division
Science Mission Directorate
Suite 3W39
NASA Headquarters
Washington, DC 20546-0001

Subject: Final Environmental Impact Statement (DEIS) for the Outrigger Telescopes Project [CEQ # 050058]

Dear Dr. Pilcher:

The U.S. Environmental Protection Agency (EPA) has reviewed the above-referenced document pursuant to the National Environmental Policy Act (NEPA), Council on Environmental Quality (CEQ) regulations (40 CFR Parts 1500-1509) and Section 309 of the Clean Air Act.

We rated the Draft EIS as Environmental Concerns, Insufficient Information (EC-2). While EPA recognizes the scientific importance of the W.M. Keck Observatory on Mauna Kea and supported the recent decision to complete an EIS for this project, we expressed concerns that the negative impacts associated with locating additional structures on this sacred site would primarily impact Native Hawaiians. We continue to be concerned with the cultural and habitat impacts from the project as proposed.

The Final EIS concludes that the Gran Telescopio de Canarias site in La Palma, Canary Islands, would have fewer impacts to transportation, cultural resources, air quality, noise levels, and visual resources, while meeting the purpose and need. It would also avoid impacts to the Wekiu bug, a candidate for listing under the Endangered Species Act. If the proposed action is adopted, we recommend that the Record of Decision specifically address 40 CFR 1505.2 (b) and (c). These regulations require that the environmentally preferable alternative be identified and that all practicable means to avoid or minimize environmental impacts are incorporated.

The Draft and Final EIS conclude that the project would not have a disproportionately high or adverse human health or environmental effects on minority populations (FEIS, page 4-44) while acknowledging that the cumulative effects of past projects and planned projects will continue to have a substantial and adverse impact on the cultural, biological, visual, and geological resources of Mauna Kea (FEIS, page 4-124). While, these impacts will be primarily on the Native Hawaiians that hold these areas as sacred, this is not considered an Environmental Justice issue because of the lack of human populations in the area. We note that CEQ's Environmental Justice Guidance Under NEPA includes the analysis of cultural impacts on minority communities when those "impacts are interrelated to impacts on the natural or physical environment" (p. 26, CEQ Guidance, 1997).

EPA has reviewed the scoping comments and comments on the Draft EIS, and we are concerned that Environmental Justice concerns have not been fully addressed in the Final EIS. We recognize that an integrated resource management planning approach to ensure that impacts to cultural resources, visual resources, and biological resources are avoided or mitigated, is the responsibility of the Office of Mauna Kea Management. However, since NASA is providing $2 million for mitigation, it is important that an integrated planning approach be used to determine the best overall use of those funds. We also note that according to NASA's EJ strategy (1995), each NASA center is responsible for developing its own EJ Implementation Plan. Because of the increasing impacts to cultural resources, NASA should consider preparing an EJ Implementation Plan for the Mauna Kea Complex.

Additionally, we have continuing concerns over the selection and role of the cultural monitor and recommend that the Office of Mauna Kea Management be involved in selection of and have oversight of the cultural monitor and archaeologist. The cultural monitor should have authority to halt construction activity in an area if there are impacts or potential impacts to cultural resources. While we recognize the efforts to involve the public, NASA should continue to consult with Native Hawaiian organizations throughout development of the project to address their concerns. The Record of Decision should clearly commit to a continued and substantive dialogue with Native Hawaiians throughout the construction and operation of the project.

Although currently, ultra-low sulfur diesel fuel is not available in the island of Hawaii, other appropriate controls, such as specialized catalytic converters, to reduce emissions of diesel particulate matter and other air pollutants that will result from the use of construction equipment, should be implemented. We also note that by 2006, ultra low-sulfur diesel fuel will be available in all 50 states (see Summary and Analysis of the Highway Diesel Fuel 2004 Pre-Compliance Reports, EPA- September 2004). Use of this fuel and particle traps for any construction after 2006, should be incorporated into the mitigation measures and reflected in the Record of Decision.

We appreciate the opportunity to review this FEIS. Please send two copies of the Record of Decision to this office when it is officially filed with our Washington, D.C. office. In the meantime, if you have any questions, please call Summer Allen, the lead reviewer for this project, at (415) 972-3847.

Sincerely,

Lisa B. Hanf

Lisa B. Hanf, Manager
Federal Activities Office

MI# 003596

cc: Dr. Wendy Wiltse, US EPA, Pacific Islands Contact Office, Honolulu
Genevieve Salmonson, Director, Office of Environmental Quality Control, Honolulu

RESPONSE TO ISSUES RAISED IN
EPA, REGION 9 LETTER
DATED MARCH 4, 2005

There is a general concern "with the cultural and habitat impacts from the project as proposed." [Page 1, paragraph 2]

As evidenced by NASA's frequent consultations with interested parties and the general public and the extensive set of proposed mitigation measures, NASA takes seriously the potential impacts on cultural resources and habitat.

With regard to cultural resource impacts, NASA has engaged in extensive consultations with the Hawaii State Historic Preservation Division, the Advisory Council on Historic Preservation (ACHP), and several Native Hawaiian organizations, as well as others. The ACHP's Native American Program Coordinator was called upon during NASA's deliberations. These consultations culminated in a Memorandum of Agreement (MOA) designed to mitigate the adverse effects of the proposed project that was signed by NASA, the ACHP, the Hawai'i State Historic Preservation Office, and some other Consulting Parties.

Regarding "habitat impacts", the U.S. Fish and Wildlife Service has been actively involved during the analysis of potential impacts on the Wekiu bug and its habitat and review of mitigation and monitoring measures designed to reduce impacts on this and other species.

NASA's efforts to address these issues, including NASA's committed mitigation measures, are set forth in further detail in the Final Environmental Impact Statement (FEIS) and this Record of Decision (ROD). Some additional detail is also provided in the following responses.

Environmental Justice (EJ) issues

a. **There is no discussion of cultural resource impacts in the EJ Section of the Final Environmental Impact Statement (FEIS). [page 2, paragraph 1 and paragraph 2, sentence 1]**

The impacts on cultural resources are analyzed in Sections 4.1.1 and 4.2.3 of the FEIS. The discussion clearly reflects the fact that these impacts are focused on Native Hawaiians. NASA, in the last paragraph of Section 4.2.3.4, concludes that "From a cumulative perspective, the impact of past, present, and reasonably foreseeable future activities on cultural resources on Mauna Kea is substantial and adverse. The addition of the Outrigger Telescopes to the existing observatories on the mountain would have a small incremental impact." The mitigation agreed upon in the MOA demonstrates that NASA recognizes that certain impacts are only felt by Native Hawaiians. While the EJ Section (4.1.13) of the FEIS does not repeat or summarize the analysis in the cultural resource sections, it clearly states that "NASA recognizes the special cultural and spiritual significance of Mauna Kea to members of the Native Hawaiian community." That Section then refers the reader to other parts of the FEIS where cultural resource impacts and mitigation are addressed.

b. We note that...each NASA center is responsible for developing its own EJ Implementation Plan...NASA should prepare an EJ Implementation Plan for the Mauna Kea Complex. [page 2, paragraph 2, last two sentences]

Each NASA Center has prepared an EJ Implementation Plan because it manages and controls the use of the property within its boundaries. NASA does not manage or control the use of the Astronomy Precinct on Mauna Kea. NASA would only fund the construction, installation, and operation of the Outrigger Telescopes. The University of Hawai'i, a State organization, manages the Astronomy Precinct. However, through the mitigation measures and processes committed to in the MOA and this ROD, NASA is facilitating achievement of Environmental Justice objectives.

An integrated planning approach should be used to determine the best use of NASA's $2 million mitigation commitment. [Page 2, paragraph 2]

If the proposed project is implemented, the $2 million commitment is designated to aid in mitigating adverse impacts on cultural resources. See the MOA, Section III (FEIS, Appendix B). Whatever the wisdom of an integrated planning approach, the Native Hawaiian groups with which NASA consulted made it clear that the Hawaiian community, not NASA, the Office of Mauna Kea Management (OMKM), or any other outside party, must decide the best use of NASA's monetary commitment for mitigation. NASA accepted this position, and the MOA therefore states that the Hawaiian working group will decide how best to expend the funds.

There are also a myriad of other mitigation measures that would be employed in addition to the $2 million. See, for example, Chapter 5 and Appendices B, C, D, E, and F of the FEIS.

OMKM should be involved in the selection and oversight of the cultural monitor and archaeologist. [Page 2, paragraph 3, sentence 1]

The MOA, Sections I.C.1 and I.D.1, provides OMKM a role in the selection of both the cultural monitor and archaeologist. The Hawai'i Board of Land and Natural Resources (BLNR) has issued a conservation District Use Permit (CDUP) for the proposed project that specifies OMKM oversight of the cultural monitor and archaeologist. Presently that permit is under dispute. NASA will ensure compliance with any State permit conditions.

The cultural monitor should have authority to halt construction activity. [Page 2, paragraph 3, sentence 2]

The MOA, Section I.C.2.e, envisions circumstances in which the cultural monitor would have such authority.

NASA should continue to have a dialogue with Native Hawaiians throughout implementation of the project. [page 2, paragraph 3, sentences 3 and 4]

The MOA, Sections 2.F.2 and 2.F.3, provides for reasonable access of the Native Hawaiian Consulting Parties to the site and a NASA point of contact in the event that they have any concerns.

Ultra low-sulfur diesel fuel and particle traps should be used for any construction after 2006. [Page 2, paragraph 4]

NASA will ensure such use for Outrigger Telescopes construction after 2006 if such fuel is reasonably available on the island of Hawai'i.